US009334720B2

(12) **United States Patent**
Burnette et al.

(10) **Patent No.: US 9,334,720 B2**
(45) **Date of Patent: May 10, 2016**

(54) **TUBLESS PROPPANT BLENDING SYSTEM FOR HIGH AND LOW PRESSURE BLENDING**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 121 days.

(21) Appl. No.: **13/858,732**

(22) Filed: **Apr. 8, 2013**

(65) **Prior Publication Data**

US 2014/0299321 A1 Oct. 9, 2014

(51) **Int. Cl.**

E21B 43/26	(2006.01)
E21B 43/267	(2006.01)
E21B 43/25	(2006.01)
E21B 43/16	(2006.01)

(52) **U.S. Cl.**

CPC ***E21B 43/267*** (2013.01); *E21B 43/16* (2013.01); *E21B 43/25* (2013.01)

(58) **Field of Classification Search**

CPC E21B 43/16; E21B 43/26; E21B 43/25; E21B 43/267

USPC 166/308.4, 305.1, 90.1

See application file for complete search history.

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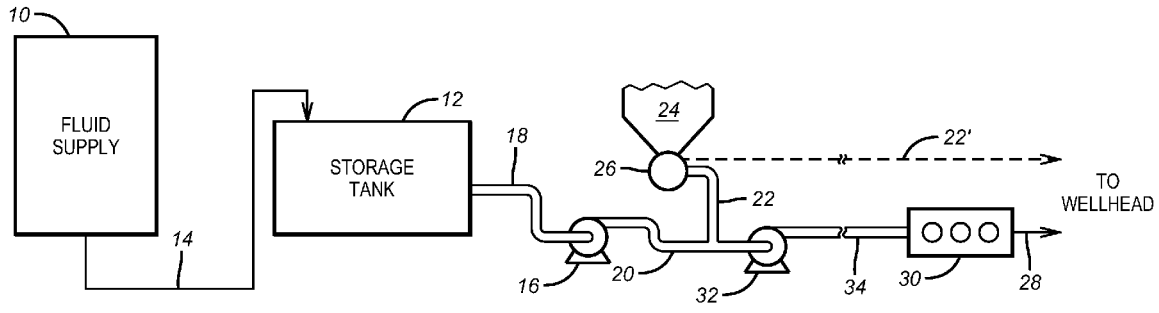
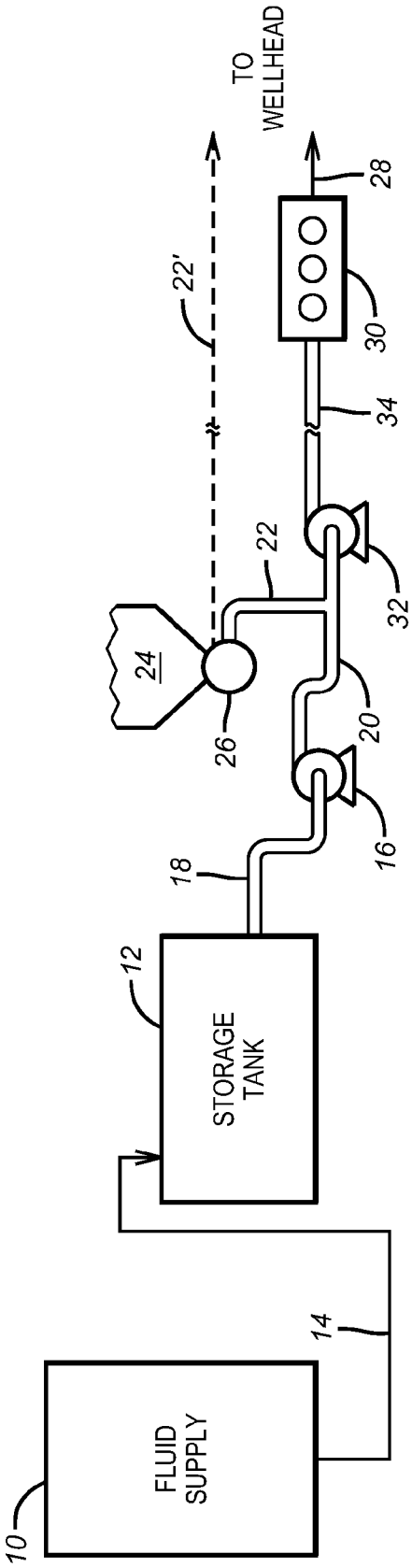
(57) **ABSTRACT**

Fracturing slurries are prepared on the fly using a solids pump to feed the solid such as a gel into a liquid stream of normally water for pumping downhole with a large capacity triplex pump. The solids pump is preferably a Posimetric® style which delivers the solid into the fluid pipeline in a manner that keeps fluid from backing into the solids hopper above the solids pump. A separate fluid tank is connected to a fluid pump to pressurize a suction line to a boost pump before reaching the triplex pump and pumping into the subterranean formation. The solids pump can deliver between the fluid and boost pumps in which case the solids go through the triplex pump or alternatively the solids can be delivered into the higher pressure discharge line of the triplex pump.

15 Claims, 1 Drawing Sheet




TO WELLHEAD
28
30
22'
34
22
32
24
26
20
16
18
12
STORAGE TANK
14
FLUID SUPPLY
10

TUBLESS PROPPANT BLENDING SYSTEM FOR HIGH AND LOW PRESSURE BLENDING

FIELD OF THE INVENTION

The field of the invention is blending systems for solids and fluids for subterranean use and more particularly for fracturing.

BACKGROUND OF THE INVENTION

Fracturing involves pumping large volumes at high pressure into a formation to initiate and extend fractures and later to extract hydrocarbons. The material that is pumped is invariably water with a small percentage by weight of solids such as proppants that are used to create and hold open the produced fractures with the high pressure associated with the slurry flow.

In the past the slurry was prepared at the surface using a mix tank connected to a water line. The solids were tossed into the top of the tank and significant horsepower was needed to drive one or more agitators to keep the solids from precipitating in the tank and to maintain a slurry of uniform consistency for the fracturing process that occurred at the subterranean location. The slurry would then be delivered to an inlet of a triplex pump to deliver the requisite volume and the needed pressures. These pumps are large 3 cylinder piston pumps driven by a diesel engine although more recently natural gas driven engines have been used.

Pumps that deliver solids into fluid piping systems have been used primarily in the coal fired utility industry and are marketed by General Electric Company under the trademark Posimetric®. These pumps are described and deployed in U.S. Pat. No. 8,307,975; US Publication 20120027663 and US Publication 2012/0107058.

The use of a mix tank with agitators presents issues of space that can be in short supply at some well locations as well as maintenance and operational consistency issues. The present invention seeks improve the systems for slurry preparation for use in subterranean operations, notably fracturing by elimination of the mixing equipment described above and using a solids pump to deliver to the suction or discharge of a fracturing pump that also receives the fluid supply. These and other aspects of the present invention will become more readily apparent to those skilled in the art from a review of the detailed description and the associated FIGURE while recognizing that the full scope of the invention is to be determined from the appended claims.

SUMMARY OF THE INVENTION

Fracturing slurries are prepared on the fly using a solids pump to feed the solid such as a gel into a liquid stream of normally water for pumping downhole with a large capacity triplex pump. The solids pump is preferably a Posimetric® style which delivers the solid into the fluid pipeline in a manner that keeps fluid from backing into the solids hopper above the solids pump. A separate fluid tank is connected to a fluid pump to pressurize a suction line to a boost pump before reaching the triplex pump and pumping into the subterranean formation. The solids pump can deliver between the fluid and boost pumps in which case the solids go through the triplex pump or alternatively the solids can be delivered into the higher pressure discharge line of the triplex pump. The system can be used also for cementing.

BRIEF DESCRIPTION OF THE DRAWING

The FIGURE is a schematic representation of one possible configuration for the system of the present invention and illustrates a possible alternate arrangement.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A fluid supply **10** holds water or other liquids and is connected to a storage tank **12** by line **14**. The water supply is in many cases brought to a well site with 18 wheelers. Fluid pump **16** is connected by line **18** to bring the water through discharge line **20**. The line **22** connects with discharge line **20** for delivery of solids, semisolids or other materials from the storage vessel **24**. The solids pump **26** can deliver from the vessel **24** through line **22** or line **22** can be eliminated and the discharge from pump **26** can go directly into line **20**. In an alternative embodiment the solids can be fed into line **28** that goes to the wellhead (not shown). The frac pump **30** is fed by boost pump **32** through line **34**. Line **20** extends on one end to the boost pump **32**. If the solids pump **26** delivers into line **20** then boost pump **32** and frac pump **30** both handle slurry. On the other hand if the solids are delivered through line **22'** then pumps **30** and **32** do not see solids but the tradeoff is that the pump **26** horsepower requirement goes up substantially as the solids must be injected into a line that has orders of magnitude higher pressure than line **20**. On the other hand, one of the pumps **16** or **32** can be eliminated if the solids are delivered downstream of frac pump **30**.

Instead of water the fluid **10** can be a polymer based gel or non-aqueous fluid, foams, gases such as nitrogen and liquid CO2, LNG, etc. The solid material in vessel **24** can be sand, powdered cement or a dry chemical additive.

Those skilled in the art will appreciate that a fracturing or cementing system and method is described that removes the need to premix solids with a carrier fluid in an agitated tank before pumping the slurry into the subterranean location. Instead the solids are delivered to the pressurized liquid line either before or after the frac pump. Preferably the solids are directly delivered to line **20** that works at fairly low pressures as the capacities of the pumps **16** and **32** are evenly matched. Injection of solids into a lower pressure line also takes less horsepower driving the solids pump **26**. Although a Posimetric® pump is preferred other solids delivery devices that compress the solid delivered near the point of discharge to prevent fluid backup into the solids pump are also contemplated. The advantages are space and reliability gains as an agitated mix tank is eliminated along with agitator horsepower requirements. in the alternative embodiment of injecting the solids downstream of frac pump **30** one of the two pumps **16** or **32** can be eliminated and less wear on the frac pump **30** is experienced as the solids bypass that pump altogether.

The above description is illustrative of the preferred embodiment and many modifications may be made by those skilled in the art without departing from the invention whose scope is to be determined from the literal and equivalent scope of the claims below:

We claim:

1. A fracturing method, comprising:

making a slurry on the fly by injecting a solid proppant in a dry state with a solids pump into a pressurized fluid pipe for initial fluid mixing in said pipe on a discharge side of an injection pump without an intervening blending tank;

pumping said slurry with said injection pump to a subterranean formation;

fracturing the formation.

2. The method of claim **1**, comprising:

providing a fluid storage vessel and associated fluid pump to remove the fluid from the vessel;

directing the discharge of said fluid pump to the suction of a booster pump.

3. The method of claim **1**, comprising:

using a Posimetric® pump as said solids pump.

4. The method of claim **1**, comprising:

using water, a polymer based gel, non-aqueous fluid, foam, nitrogen gas, liquid CO2, or LNG as said fluid.

5. The method of claim **1**, comprising:

using sand, powdered cement or a dry chemical additive as said solid.

6. The method of claim **2**, comprising:

injecting the solid into a pressurized conduit between said fluid and booster pumps.

7. The method of claim **6**, comprising:

providing a line from a solids pump discharge into the pressurized conduit between said fluid and booster pumps.

8. The method of claim **6**, comprising:

discharging solids from the discharge connection on the solids pump at the pressurized conduit between said fluid and booster pumps.

9. The method of claim **1**, comprising:

using a frac pump at a surface location for said pumping.

10. The method of claim **9**, comprising:

injecting said solid upstream of said frac pump.

11. The method of claim **9**, comprising:

injecting said solid downstream of said frac pump.

12. The method of claim **11**, comprising:

using a booster pump upstream of said frac pump to pressurize fluid from a storage vessel.

13. The method of claim **11**, comprising:

delivering the solid into the pressurized fluid conduit with a solids pump.

14. The method of claim **13**, comprising:

connecting the discharge of said solids pump directly or indirectly to the pressurized fluid conduit downstream of said frac pump.

15. The method of claim **14**, comprising:

using a Posimetric® pump as said solids pump.

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